Tune-up After A18 Alignment

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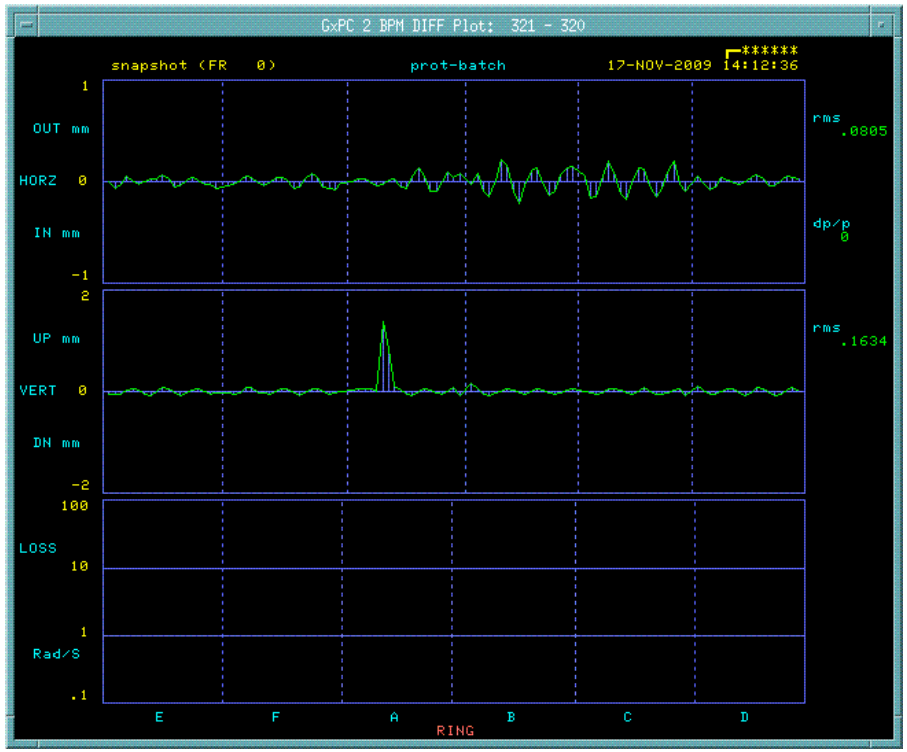
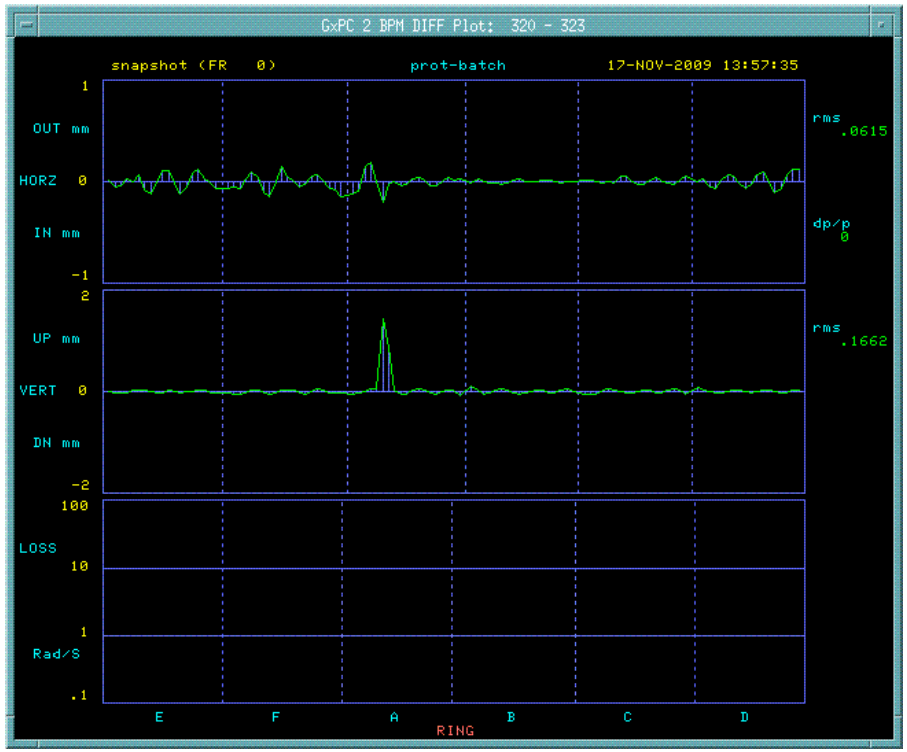
Pre-Alignment Thoughts and Studies

- After the shutdown VA18 was running at -45A, which is consistent with +3 mm quad offset. Alignment data showed +2.5 mm.
- A18 BPM showed -1.5 mm offset w.r.t. nominal orbit. Thus, total offset would be 3-1.5=+1.5 mm.
- Primary motivation for re-alignment was to lower the corrector current
- The A18 spool contains two sextupoles (S5 and SDA2U). Vertical orbit offset at a sextupole produces differential coupling and differential orbit kick in the horizontal plane. This leads to a change of the proton/pbar lattice and helix. This was verified in the 11/17 EOS study.
- Re-alignment of the quad would move the orbit through the spool to its original location.

Vertical 4-bump at A18. 11/17 EOS

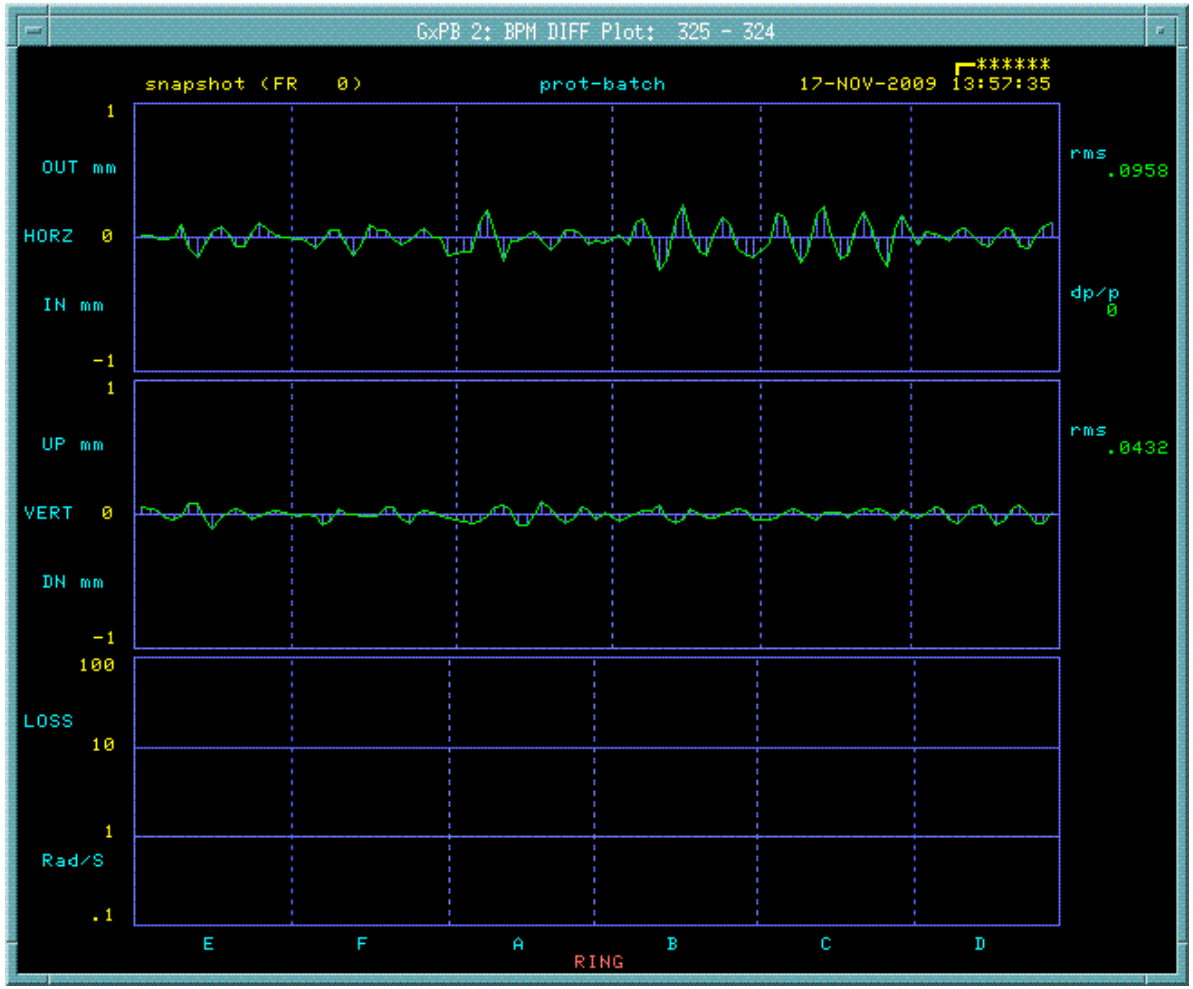


+1.5 bump - Nominal



Nominal - -1.5 mm bump

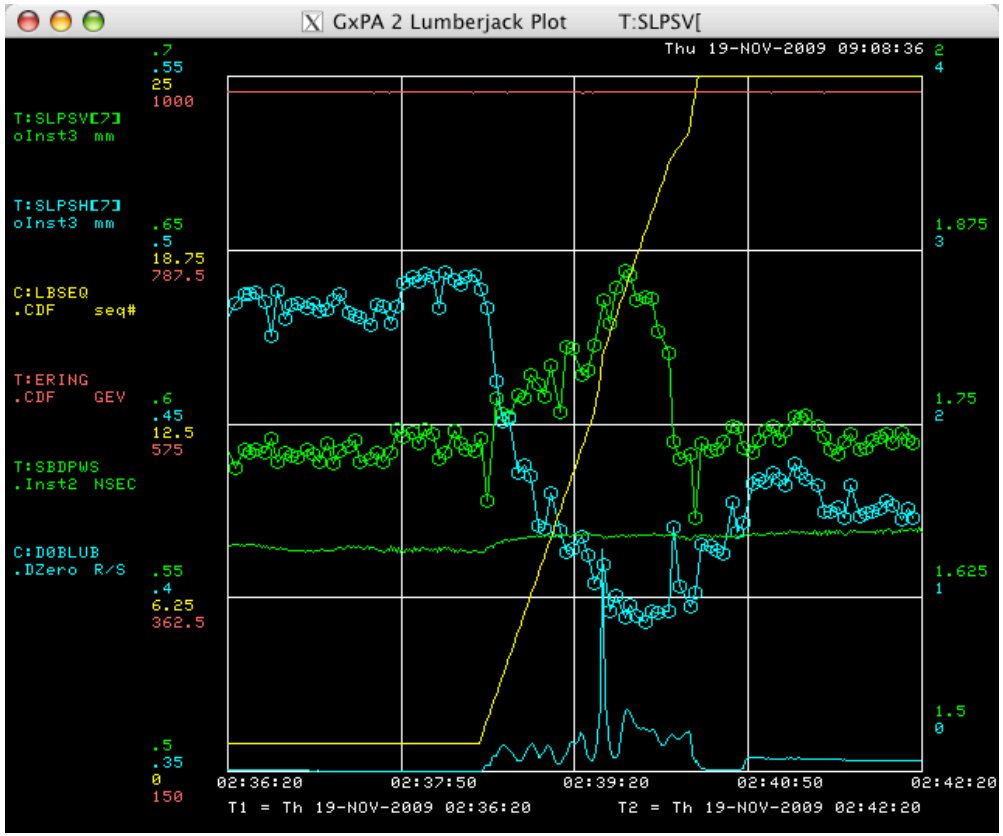
Vertical 4-bump at A18. 11/17 EOS



Positive bump + Negative bump

Tune-up After Re-Alignment

- VA18 current was decreased by amount consistent with .060” move
- No coupling or tune adjustment was needed up the ramp or through the squeeze.
- Vertical 4-bump at A18 had no effect on tunes/coupling at either helix
- Losses at sequence 15 seem to be better
- Collision optics was very much mis-tuned – found coupling on the proton helix .006, on the pbar helix 0.01.
  - S7 had some effect on pbar helix (new effect)
  - SQ was efficient on the proton orbit.
  - Differential effect of D0 skew quads (+ for pbars, - for protons) did not change
- Tunes are un-crossed
- Proton blowup at lbseq=15



Next Steps

- Understand orbit offset in the spool
- Repeat in-store orbit bumps to measure the cross-plane response
- LowBeta optics measurement
  - Why are tunes uncrossed?
  - What is the reason for large difference in pre- and post- shutdown tune settings? e.g. proton vertical tune setting changed by -0.007, pbar vertical by -.0006
    - Tune mult calibration could help